REMARKS

Applicants have amended the drawings and the Specification to make the Specification and drawings consistent. The claims have been amended to clarify the Applicants invention and overcome Examiners objections and rejections, and the Specification as been amended to correct grammatical corrections and clarify Applicants disclosure. No new Matter has been added. For example support for amended claims 1 and 14 is found in the specification, beginning at page 16, paragraph 0029:

"In contrast, after using the method and apparatus according to the present invention, HBr concentrations present on a process wafer following an etching process, for example, an STI etching process, were reduced to less than 0.05 ppm. **As a result, acidic contamination levels were reduced in the loadlock chambers and wafer processing defects** due to corrosive action were likewise reduced thereby increasing overall wafer processing throughput and semiconductor feature (e.g., STI features) quality. Moreover, the corrosive action that the etching system parts have been subjected to by acidic contamination such as the robotic arm and loadlock chamber parts according to the prior art has been reduced according to the present invention."

beginning at page 11, paragraph 0022:

"In the method and apparatus according to the present invention, **a heating chamber, 34, is added to the multi-chamber system to heat the process wafer prior to transfer by robotic arm 36 to a loadlock chamber e.g., 30 or 32 for unloading.**

beginning at page 13, paragraph 0024:

"According to the present invention, the process wafer is heated by convective and conductive methods preferably **by passing a heat transfer fluid through a base plate equipped with a heat exchange manifold with the base plate in contact with the process wafer.**"

beginning at page 13, paragraph 0024:

"For example, according to the present invention, **a wafer support plate (base plate)** used in the cooling chamber of the prior art in as shown in Figure 1 at 24 may be modified or replaced with a heat exchange system according to the present invention to allow a heat transfer fluid in communication with a heat exchanger to pass heat exchange fluid through the base plate heat exchange manifold to convectively and conductively remove heat from the process wafer."

Support for new claim 21 is found in the Specification beginning at page 14, paragraph 0025:

"According to the present invention, the heat exchanger is preferably attached external to the process chamber and **may be advantageously equipped with an interlock flow switch to alert the operator should fluid flow be interrupted**. Any suitable interlock flow switches, which are well known in the art, may be used."

Drawing Objections

Examiner has objected to the drawings under 37 CFR 1.83(a) because (The drawings must shown every feature of the invention specified in the claims. Therefore the heat exchange surface in

fluid communication with the heat exchanger, the fluid communication flow path between the heat exchanger and the heat exchange surface, the heat exchanger provided with means for sensing the flow rate and means for sensing a temperature in a flow path **must be shown or the features cancelled from the claims**".

Applicants have amended the claims to conform to the Specification by making it clear that the heat exchange fluid passes through the wafer support plate Base plate) which comprises a heat exchange surface. The process wafer formerly shown as item 308 has been changed to 305 in the drawings and Specification. "Means for sensing the flow rate and means for sensing a temperature in a flow path have been removed from the claims"

Claim Rejections Under 35 USC §112 second paragraph

Claims 5-11 and 14-20 stand rejected under 35 USC 112 second paragraph. Applicants have overcome Examiners rejections by amending or canceling the relevant claims.

Claim Rejections under 35 USC 102(b)

Claims 14-17 stand rejected under 35 USC 102(b) as being anticipated by Jeng et al. (U.S. 5,282,925). Jeng et al.

disclose a device and method for applying and removing a thin layer of etchant on a wafer surface by controlled condensation and vaporization of NH_3 and HF to etch silicon dioxide, (see e.g., Abstract, col 6, lines 48-69; col 8, lines 10-25). Jeng et al. disclose **cooling** a wafer to condense the etchant gases onto the wafer surface by passing coolant **through the wafer support,** (see col 10, lines 15-25), followed by heating the process wafer to desorb the etchant. Jeng et al. teach alternative methods for heating including heating the wafer with a resistive heater, pulsed light from a laser or lamp or an electro or ion beam heater (e.g., col 20, line 25-35). Jeng et al. in one embodiment disclose passing a heating fluid through the wafer support (col 14, lines 35-40) if the pressure in the chamber rises too high in the desorption step.

The principal of operation of the apparatus and method of Jeng et al. is inconsistent with the principal of operation of the apparatus and method of Applicants which is to desorb residual acidic residues following a plasma etching operation by simultaneously heating the wafer and applying vacuum pressures. Jeng et al. does not disclose several elements of Applicants claimed invention nor recognize or suggest a solution to the problem Applicants have recognized and solved as in amended claim 14:

"A heating chamber system for reducing plasma etching residue to avoid acidic contamination on a process wafer and in a loadloack chamber following a plasma etching process comprising:

an ambient controlled heating chamber separate from an etching chamber and a loadlock chamber for accepting transfer of a process wafer under controlled ambient pressure conditions following a plasma etching process;

a wafer support plate disposed within the heating chamber for mounting the process wafer;

a heat exchanger disposed externally to the heating chamber for controlling a temperature of a heat exchange fluid passed through the wafer support plate;

a means for supplying a continuous flow of the heat exchange fluid;

whereby, the process wafer temperature and the ambient pressure may be simultaneously controlled to vaporize and remove plasma etching residues from the process wafer."

Jeng et al. is clearly insufficient to anticipate Applicants disclosed and claimed invention.

Claim Rejections under 35 USC 103(a)

1. Claims 1-4 and 8-20 stand rejected under 35 USC 103(a) as being unpatentable over Applicants admitted prior art in view of Kim et al. (US 6,073,636, or 5,972,161) and Jeng et al. Note Applicants discussion applies to both cited Kim et al. references since the disclosures are substantially the same or identical,

although Applicants references (columns and line numbers) are to 5,972,161.

Kim et al. disclose a dry etcher including a loadlock chamber and etching chamber where **a heater or cleaning device prevents residual reaction remaining in the etching chamber and loadlock chamber** from recondensing on the process wafer (see Abstract). The disclosure of Kim et al. is at best consistent with Applicants disclosed state of the prior art in the Background of the Invention:

"Figure 1 shows a typical process chamber configuration used in STI etching. The typical process chamber, for example, includes several different etching chambers, 10, 12, 14, and 16, in addition to a wafer orientation chamber 18, a cool down chamber 24 and loadlock chambers 20 and 22. The robotic arm transfer mechanism is centrally located at 26. In a typical process in STI etching, as explained, several different etching steps with different etching chemistries may be involved thus having the process wafer transferred by robotic arm 26 between multiple etching chambers, for example 10, 12, 14, and 16. Following etching, the process wafer may be transferred by robotic arm 26 to cool down chamber 24 to cool the process wafer prior to transfer to a loadlock chamber, for example, 20 or 22 where the chamber is pressurized to atmospheric pressure for unloading.

During this process, corrosive acids, such as HBr may condense onto the process wafer surface which also contains for example, loose particles from the etching process. Further, during the pressurization process the particles may become dislodged and adhere to the chamber walls and robotic arm thereby causing corrosive damage to the chamber and robotic arm as well as to the process wafer. As a result, over time, the loadlock chambers accumulate residual corrosive particles which can cause damage to process wafers as they are moved through the loadlock chamber thereby necessitating frequent equipment shutdown for cleaning. Another shortcoming of the prior art procedure and apparatus for STI etching may be potential adverse health consequences to equipment operators from an undesired buildup of such contamination."

"First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. **The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure.** *In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).*

Thus, Kim et al., while recognizing a **similar** problem, have not provided or suggested Applicants' solution to the problem that Applicants have recognized and solved by their disclosed and claimed invention as in claim 1:

"A method for reducing acidic contamination on a process wafer and in an unloading chamber following a plasma etching process to reduce acidic residue contamination comprising the steps of:

providing an ambient controlled heating chamber separate from an etching chamber and unloading chamber for accepting transfer of a process wafer under controlled ambient conditions prior to transfer to the unloading chamber;

transferring the process wafer to the heating chamber under controlled ambient conditions following plasma etching of the process wafer;

providing a heat exchange surface comprising a wafer support plate within the heating chamber for heating the process wafer;

heating the process wafer by supplying a heat exchange fluid through the wafer support plate to heat the process wafer to vaporize acidic residue remaining on the process wafer from the plasma etching process to form acidic vapors; and,

simultaneously applying a vacuum pressure to the heating chamber to remove~~ing~~ the acidic vapors from the heating chamber."

Kim et al. on the other hand, disclose a heater such as a UV lamp or halogen lamp in a loadlock chamber (e.g., col 3, lines 332-40), in the **loadlock (unloading) chamber or etching chamber to heat the entire chamber.** Kim et al. also disclose an

"electric heater" in the loadlock chamber (col 3, lines 45-48) disclosed to **heat the entire chamber** (see Fig 3 item 81) clearly not teaching Applicants disclosed and claimed invention and teaching away therefrom.

Kim et al. teach away from Applicants disclosed and claimed invention by teaching a different heating process from Applicants and carried out in the **etching chamber or loadlock chamber**, in addition to failing to teach **simultaneous application** of a vacuum pressure and the heating process as Applicants have disclosed and claimed. The method of Kim et al. not only does not recognize and solve the problem that Applicants have recognized and solved including avoiding acidic residue contamination in a loadlock chamber, but operates by a different principal and could likely lead to the very problem that Applicants have solved.

"A prior art reference must be considered in its entirety, i.e., as a whole including portions that would lead away from the claimed invention." *W.L. Gore & Associates, Inc., Garlock, Inc., 721 F.2d, 1540, 220 USPQ 303 (Fed Cir. 1983), cert denied, 469 U.S. 851 (1984).*

"If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims prima facie obvious." *In re Ratti, 270 F.2d 810, 123, USPQ 349 (CCPA 1959).*

There is no apparent reason or motivation for combining Jeng et al. and Kim et al. Kim et al. teach a process and method for applying an acidic etchant **to condense on the process wafer** followed by desorption of etchant. Assuming *arguendo* that Jeng et al is analogous art, and a proper motive for combination exists, the combination of Jeng et al. and Kim et al. does not produce Applicants claimed invention.

"We do not pick and choose among the individual elements of assorted prior art references to recreate the claimed invention, but rather we look for some teaching or suggestion in the references to support their use in a particular claimed combination" *Symbol Technologies, Inc. v. Opticon, Inc., 935 F.2d 1569, 19 USPQ2d 1241 (Fed. Cir. 1991).*

2. Claims 5-7, stand rejected under 35 USC 103(a) as being unpatentable over Applicants admitted prior art in view of Kim et

al. (US 6,073,636, or 5,972,161 or GB 2,13,574) as applied to claim 1, above and further in view of Davis et al. (6,3223,463) or 6,410,889).

Note Applicants discussion applies to all three cited Kim et al. references since the disclosures are substantially the same or identical and where Applicants references (columns and line numbers) are with respect to 5,972,161.

Note that Applicants discussion applies to both cited Davis et al. references since the disclosures are substantially the same or identical, where Applicants references (columns and line numbers) are with respect to 6,410,889.

Davis et al. disclose a method and apparatus for **heating a loadlock chamber** to inhibit the formation of contaminants within the loadlock by applying a heater **to the walls** of the loadlock while removing the desorbed contaminants with a vacuum pump.

Applicants reiterate the statements made above with respect to Applicants alleged admitted prior art, Kim et al., and Jeng et al. Any combination of Davis et al. with any or all of the above cited references does not produce Applicants disclosed and claimed invention. The fact that Davis et al teach that HBr is

desorbed at temperatures of 50 to 55 °C does not help Examiner in making out a *prima facie* case of obviousness with respect to Applicants disclosed and claimed invention. Applicants respectfully suggest that Examiners result effective variable argument is without merit since Examiner has not shown the general conditions in the prior art nor any suggestion of Applicants invention including recognition of the problem that Applicants have recognized and solved.

With respect to the independent claims, since neither Jeng et al., Kim et al., nor Davis et al., including *arguendo* prior disclosed by Applicant, nor any combination of the foregoing produce Applicants claimed invention, thereby failing to make out a *prima facie* case of obviousness, neither has a *prima facie* case of obviousness been made out with respect to the dependent claims.

The Claims have been amended to clarify Applicants claimed invention and newly drafted claims added. A favorable consideration of Applicants' claims is respectfully requested.

Based on the foregoing, Applicants respectfully submit that the Claims are now in condition for allowance. Such favorable action by the Examiner at an early date is respectfully solicited.

In the event that the present invention as claimed is not in a condition for allowance for any other reasons, the Examiner is respectfully invited to call the Applicants' representative at his Bloomfield Hills, Michigan office at (248) 540-4040 such that necessary action may be taken to place the application in a condition for allowance.

Respectfully submitted,

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